Shri Vaishnav Vidhyapeeth Vishvavidhyalaya, Indore

P. G. Program M.Sc. (Physics)

Semester - IV

Subject Code	Category	Subject Name	Teaching and Evaluation Scheme								
			Theory			Practical		Th	T	P	Credit
			End Sem University Exam	Two Term Exam	Teachers Assessment	End Sem University Exam	Teachers Assessment				
MSPH 401	DC	Plasma Physics -II	60	20	20	0	0	3	1	0	4

Course Objectives	1. To develop the comprehensive understanding of laws of physics related to Plasma Physics – II and ability to apply them for laying the foundation for research and development. 2. To work ethically as member as well as leader in a diverse team.
Course Ourcomes	1. Student will be able to understand and solve the problems related to Plasma Physics - II. 2. Student will be able to determine physical parameter experimentally with optimal usage of resources and complete the assignments in time.

Abbreviation		
Th	Theory	**Teacher Assessment (Theory) shall be based on following components: Quiz / Assignment / Project / Participation in class (Given that no component shall be exceed 10 Marks).**
T	Tutorial	**Teacher Assessment (Practical) shall be based on following components: Viva/ File/ Participation in Lab work (Given that no component shall be exceed 50% of Marks).**
P	Practical	

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P. G. Program M.Sc. (Physics)

PLASMA PHYSICS - II

UNIT I: Kinetic theory of Plasma: Boltzman Equations, Equations of Kinetic Theory, Derivation of the Fluid Equations, The Meaning of Landau Damping, A Physical Derivation of Landau Damping, BGK and Van Kampen Modes, Experimental Verification.

UNIT II: Application of Plasma: Material processing, Bio-medical applications: Concept of Plasma Niddle, working and recent development, plasma sterilization, plasma surface modification of polymer, corona plasma: air and water disinfection, plasma based nanofacbrication, dielectric barrier discharge (DBD), plasma etching.

UNIT III: Diagnostics of Plasma: Single Probe Technique: Measurement of Electron Temperature and Electron ~~Temperature~~ Density of Plasma, Double Probe Technique: Measurement of Electron Temperature and Density of Plasma.

UNIT IV: Plasma Processing: DC-Discharges, Types of Low Pressure Discharges, Regions in a Glow Discharge, Processes in the Cathode Region, The Hollow Cathode Effect, Thermionic Emitters, The Negative Glow, The Positive Column, PACVD techniques.

UNIT V: Dusty and Quantum plasma: Laser Induced Plasma Medium, Strongly and Weakly coupled plasma, conditions for strongly coupled plasma, Quantum plasma, Dusty Plasma, Charging of dust particles, Forces on dust particles.

References

1. J D Jackson: Classical electrodynamics (Berkley, California, 1974).
2. J A Bittencourt: Fundamentals of Plasma Physics (Springer, III Edition).
3. F F Chen: Introduction to Plasma Physics (Plenum Press, III Print).
4. Introduction of dusty plasma, P. K. Shukla.
5. Quantum Plasma, F. Haas.

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P. G. Program M.Sc. (Physics)

Semester - IV

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			Theory			Practical		Th	T	P	Credit
			End Sem University Exam	Two Term Exam	Teachers Assessment	End Sem University Exam	Teachers Assessment				
MSPH402	DC	Material Science - II	60	20	20	0	0	3	1	0	4

Course Objectives	1. To develop the comprehensive understanding of laws of physics related to Material Science – II and ability to apply them for laying the foundation for research and development. 2. To work ethically as member as well as leader in a diverse team.
Course Ourcomes	1. Student will be able to understand and solve the problems related to Mateiral Science - II. 2. Student will be able to determine physical parameter experimentally with optimal usage of resources and complete the assignments in time.

Abbreviation		Teacher Assessment (Theory) shall be based on following components: Quiz / Assignment / Project / Participation in class (Given that no component shall be exceed 10 Marks).
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P. G. Program M.Sc. (Physics)

MATERIAL SCIENCE-II

UNIT I: Mechanical properties of materials, Stress and strain behavior, Elastic properties of materials, Plastic deformation, tensile properties, compressive and shear deformation, hardness, creep, fracture, fatigue.

UNIT II : Magnetic materials: Magentocrystalline anisotropy, Induced magnetic anisotropy, Magnetostrction, Magentoelastic energy, Magnetoelastic coupling, Volume changes in magentostriction, Villari effect, Wiedemann effect, Inverse Wiedemann effect, Matteucci effect, ΔE effect, Barkhausen effect, Magentization process, Technical magnetization, Magnetic after effect, Soft and hard magnetic materials, Ferrites their structure and uses..

UNIT III: Corrosion: Mechanisms of localized corrosion, Oxidation, Thermodynamics oxidation, Oxidation resistance, Acquaous corrosion, Anodic dissolution, Corrosion prevention Development of environmentally-friendly protective coating systems

UNIT IV : Materials superconducting at liquid Helium temperatures, High- T c metal oxides, Organic materials, Fullerenes, Borocarbides and Diborides, Preparation and characterization of superconducting materials, Crystal Structure, Phase Diagrams and Application of Low and High- T c superconductors.

UNIT V: Liquid phase synthesis Precipitating Nanoparticles: (1) colloidal methods; (2) sol – gel processing; (3) water – oil microemulsions method; (4) hydrothermal synthesis; and (3) water – oil microemulsions method; (4) hydrothermal synthesis; and (5) polyol method.

References

1. Materials Science and Engineering, W. D. Callister, Jr. Wiley Eastern Limited, 1984.
2. Superconductivity Today, T. V. Ramakrishnan and C. N. R. Rao, Wiley EasternLimited, 1992.

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Semester - IV

Subject Code	Category	Subject Name	Teaching and Evaluation Scheme								
			Theory			Practical		Th	T	P	Credit
			End Sem University Exam	Two Term Exam	Teachers Assessment	End Sem University Exam	Teacher Assessment				
MSPH403	DC	Laser Physics - II	60	20	20	0	0	3	1	0	4

Course Objectives	1. To develop the comprehensive understanding of laws of physics related to Laser Physics – II and ability to apply them for laying the foundation for research and development. 2. To work ethically as member as well as leader in a diverse team.
Course Ourcomes	1. Student will be able to understand and solve the problems related to Laser Physics - II. 2. Student will be able to determine physical parameter experimentally with optimal usage of resources and complete the assignments in time.

Abbreviation		
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LASER PHYSICS - II

Unit I: Multimode and pulse lasing Introduction, Q-Switching, Methods of Q Switching: Mechanical Q-Switching , Electro-Optic Q-Switching, Multimode Laser Oscillation, Phase-Locked Oscillators, Mode Locking, Amplitude-Modulated Mode Locking, Frequency-Modulated Mode Locking, Methods of Mode Locking.

Unit II: Optical Fibre Communication: Introduction, Ray Theory of Light Propagation through Optical Fibre, Acceptance Angle, Numerical Aperture, Types of Optical Fibre: SMF and MMF, Pulse Dispersion: Its Types and Impact on Information capacity, Graded Index Optical Fibre, Attenuation and Losses in Optical Fibre, Applications of Optical Fibre.

Unit III: Laser Material processing: Cutting, Welding, Drilling, Transformation Hardening, Melting and Rapid Solidification, Surface Alloying, Laser Cladding, Laser Glazing.

Unit IV: Atomic Energy: Uranium Isotope Separation (Enrichment of U_{235}), Laser induced fusion, Defense Applications: Target Designation, Range finger, Guided missile and bomb, Anti missile system.

Unit V: Laser Doppler Velocity-Metery, Laser Application in Pollution Detection and Environmental Measurements, Medical Applications of Lasers: Eye Surgeries, Endoscopic Surgeries, Laser Skin treatments.

References

1. Introduction to Atomic and Molecular Spectroscopy by V.K.Jain
2. Lasers - Fundamentals and Applications, K. Thyagarajan, Springer.
3. Medical Applications of Laser, D.R. Vij and K. Mahesh, Springer.
4. Optical Electronics, M. Yariv.
5. Lasers and Non-linear Optics, B.B. Laud.
6. Industrial Applications of Lasers (Second Edition), *John F. Ready*, Elsevier

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Semester - IV

Subject code	Category	Subject Name	Teaching & Evaluation Scheme								
			Theory			Practical		Th	T	P	Credit
			End Sem University Exam	Two Term Exam	Teachers Assessment	End Sem University Exam	Teachers Assesment				
MSPH404		Nano Physics - II	60	20	20	0	0	3	1	0	4

Course Objectives	1. To develop the comprehensive understanding of laws of physics related to Nano Physics – II and ability to apply them for laying the foundation for research and development. 2. To work ethically as member as well as leader in a diverse team.
Course Ourcomes	1. Student will be able to understand and solve the problems related to Nano Physics - II. 2. Student will be able to determine physical parameter experimentally with optimal usage of resources and complete the assignments in time.

Abbreviation		Teacher Assessment (Theory) shall be based on following components: Quiz / Assignment / Project / Participation in class (Given that no component shall be exceed 10 Marks).
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Nano Physics – II

UNIT I: SEMICONDUCTOR NANOSTRUCTURES

Semiconductor fabrication techniques, Electronic structure and properties of semiconductor nanostructures, Principles and performance of semiconductor nanostructures based electronic and electro-optical devices.

UNIT II: MAGNETIC NANOSTRUCTURES

Magnetism in solids-magnetic domains, Nanomagnetic properties of materials-nanostructure relationships, Fabrication and properties of nanostructured magnets, Photoinduced magnetism and spintronics, Nanomagnetic probes, Electronic magneto transport and micro magnetic modeling.

UNIT III: NANOSENSORS AND ACTUATORS

Micro and nano electromechanical systems-fabrication process, choice of materials, calculations, performance of different nanostructures, advantages and limitations of various approaches. Applications-thermal, radiation, magnetic, chemical and mechanical nanosensors and micro actuators.

UNIT IV: MOLECULAR ELECTRONICS

Conducting and semiconducting polymers-hybridization, conjugation and excitations. Molecular crystals.Organic electroluminescent displays-injection, transport, exciton formation and light emission. Influence of supramolecular order- excimers, H and J aggregates. Liquid crystal display.

UNIT V: INDUSTRIAL APPLICATIONS

Nanomaterials in bone substitutes & dentistry. Antimicrobial applications of nanomaterials. Food and cosmetic applications of nanomaterials. Application of nanomaterials in textiles, paints, catalysis, lubricants, fuel cells

References

1 J. Verdeyen, "Laser Electronics", II Edition, Prentice Hall, 1990.

2 C.W. Turner, T. Van Duzer, "Principles of Superconductive Devices and Circuits", 1981

3 Reynolds, M.Pomeranty, "Electro responsive molecules and polymeric systems", Skotheim T. Marcel Dekker New York, 1991.

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4 A. Yariv, "Principles of Optical Electronics", John Wiley, New York, 1984

Semester - III

Subject Code	Category	Subject Name	Teaching and Evaluation Scheme								
			Theory			Practical		Th	T	P	Credit
			End Sem University Exam	Two Term Exam	Teachers Assessment	End Sem University Exam	Teachers Assessment				
MSPH405	DC	Digital Electronics	60	20	20	0	0	3	1	0	4

Course Objectives	1. To develop the comprehensive understanding of laws of physics related to Digital Electronics and ability to apply them for laying the foundation for research and development. 2. To work ethically as member as well as leader in a diverse team.
Course Ourcomes	1. Student will be able to understand and solve the problems related to Digital Electronics. 2. Student will be able to determine physical parameter experimentally with optimal usage of resources and complete the assignments in time.

Abbreviation		
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DIGITAL ELECTRONICS

UNIT I: MOSFET, MESFET, HEMT and HBT: Structure, working, derivations of equations for I-V characteristics under different conditions, High frequency limits. Scaling of MOS devices and short channel FET.

UNIT II: Introduction to Logic families: TTL circuits: 7400 devices, TTL characteristics, TTL overview, Encoders and Decoders, DTL, RTL, MOS, CMOS, Classification of IC circuits: SSI, MSI. LSI, VLSI, ULSI.

UNIT III: Registers and counters: Buffer registers, Shift register, Ripple counters, Synchronous counters, Ring counters, other counters and Bus-organized computer. Flip-Flops: RS-latches, Level clocking, D-latches and flip-flops, JK master slave flip-flops.

UNIT IV: Oscillators: The phase shift oscillator, Wein bridge oscillator, LC-tunable oscillators, Multivibrator, Monostable and Astable. Simple-as-possible computer (**SAP-1**): Architecture, Instruction set, Programming, Fetch cycle, Execution cycle, Schematic diagram, Micro Programming.

UNIT V: Simple-as-possible computer-II (**SAP-2**): Bidirectional resistors, Architectures, Memory reference instructions, Registers instruction, Jump and call instructions, Logic instructions. Simple-as-possible computers (**SAP-3**): Programming model, Arithmetic instructions, Increments, decrements and multiples Logic instructions.

Reference

1. S M Sze: Semiconductor devices, (John Wiley & Sons)
2. M S Tyagi: Introduction to semiconductor materials and devices, (John Wiley & Sons)
3. M Sayer and A Mansingh: Measurement, instrumentation and experimental design in physics and engineering, (Prentice Hall of India, New Delhi)
4. Ajoy Ghatak and K Thyagarajan: Optical electronics, (Cambridge University Press)
5. J Millmann and C C Halkias: Integrated electronic: Analog and digital circuits and systems, (Tata Mcgraw-Hill Education, New Delhi)

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